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Technical Writing in America: A Historical Perspective

Michael E. Connaughton
Assistant Professor of English
Pittsburg State University
Pittsburg, Kansas 66762

> Style is the dress of thought; a modest dress,
> Neat, but not gaudy, will true critics please.
> --Samuel Wesley, "An Epistle to a Friend Concerning Poetry" (1700)

> The correspondence between every person's thoughts and language is perhaps more strict, and universal, than is generally imagined . . . [and] the ideas of words will accompany the ideas of things.
> --Joseph Priestley, The Rudiments of English Grammar (1761)

The distinction made here between Wesley's expressive and Priestley's referential language is in part responsible for the gulf between science and the humanities, and it may also account for the distress many teachers of English feel when faced for the first time with the prospect of teaching technical writing. To the humanistically educated critic-scholar, the utilitarian prose of science and technology seems to defy description and analysis, so that technical writing is often approached in terms of what it is not, with emphasis on the features of "normal" rhetoric it eschews. The technical writer's goal, Priestley elsewhere reminds us, is to "let every word stand in such a place and connection, as that its meaning shall be in no danger of being mistaken,"[1] a caveat echoed in the introduction of many of our technical writing textbooks, but which seems to divorce technical communication from other forms of linguistic experience by making language limiting and reductive rather than creative and expansive. Achieving clarity, Hugh Blair reminds us in the 1780's, is a more complex process than simply eliminating verbiage, nor is it a "sort of negative virtue, or freedom from defect."[2]

I believe that the emphasis on technical/scientific writing as radically different has blindedus to those traits it has in common with all species of composition and has caused us to neglect research on fundamental rhetorical issues. Our teaching, too, should be informed by a thorough knowledge of rhetorical theory, even if this is never communicated directly to students. A complete theory of technical discourse would include information about the attitudes and motives of writers, the situations which motivate (or coerce) them to write, the definitive features of technical style and form, the interrelationship of expression

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and scientific modes of creativity, and the functions of communication in shaping and preserving scientific networks and institutions.

These areas should be explored with respect to contemporary practice, and many researchers are presently so doing. I believe, however, that there is much to be gained by viewing them within a historical perspective. Some potential benefits of such a study, beyond those usually ascribed to historical research, include the following:

1. It would show longterm trends in technical writing and enable us to choose intelligently from the available developmental paradigms (continuum, cycle, evolution, etc.), to delineate stages, if any, in the genre's development, and to determine the relationship between scientific progress and the communication of it.

2. The written historical record concerning such subjects as the exigencies which give rise to scientific discourse or the authors' attitudes towards rhetoric may be more revealing than the stated beliefs of modern practitioners working within well-established conventions. The same holds true for the impact of Thomas Kuhn's paradigms or disciplinary matrices on scientific language. Historical material may provide a better sense of the uses of metaphoric language simply because discarded models are more easily recognized and analyzed; it may be that the corpuscular theory of matter proved deficient because of its semantic implications as well as because of experimental evidence. As in our composition classes, the failures of language may prove more analytically valuable than the successes.

3. Finally, and most important, the struggle of early scientists and engineers to create viable forms of communication, to adapt and disseminate the informational content of their developing disciplines to varied audiences, and to build acceptable channels of communication is a potentially enlightening, heretofore unexamined aspect of the history of science and technology.

This study is best carried out by teachers of rhetoric, literature, and technical writing. With well-developed critical faculties, a commitment to historical accuracy, and an orientation towards the values underlying human endeavors rather than towards the recounting--or simply counting--of the results of those endeavors, the humanities scholar is in a unique position to understand the broad implications of the history of technical writing. Specialists in the history and philosophy of science have concentrated almost exclusively on the content of scientific communication and have ignored the history of rhetoric. Brooke Hindle's ground-breaking study of the American Philosophical Society (APS), for example, ignores a large body of evidence concerning the Society's debates over the nature of scientific writing, carried on during the last decades of the eighteenth century as it initiated its Transactions, which as the first substantial scientific periodical constitutes the Society's most enduring contribution to American science.[3] Those few colleagues in our own departments who are at all interested in science deal only with its impact on literature. The few existing historical

studies of technical writing are the unsystematic appraisals of non-scholars, hastily researched and sometimes inaccurate papers and articles scattered in out-of-the-way journals and proceedings, or well intentioned but analytically unprofitable discussions of the "hidden poetry of science."

Since last summer, I have been systematically reappraising the roots of American scientific writing. Initially, I have focused on scientific and medical societies and their publications, both because the paper and report remain the standard forms of scientific discourse and because these organizations, notably the APS, possess extensive archives and libraries of early scientific activity. After only six months of research, I am not yet prepared to provide even in the broadest outline an overview of American scientific writing up to the present. I will, rather, describe its practice in the earliest phase, from the beginning in the seventeenth century until approximately 1815, when specializations begin to coalesce around professional organizations and specialized journals. In doing so, I will seek to answer some of the questions posed earlier about writers, texts, and readers.

In its initial, immature phase, American science saw its essential tasks to be observation and data compilation rather than theory formulation. This situation results from the scarcity of practitioners conversant with scientific theory and the overriding influence of Francis Bacon, whose system insisted upon these as the most fruitful scientific activities, and in part from the colonial mentality in general and a two-tiered international system of "absentee landlordship in science" in which Europeans alone were granted license to interpret data gathered from peripheral sites.[4] Like their counterparts in England, seventeenth-century Americans presented their observations in the unadorned, nominal style of the Royal Society, with figurative language employed only to translate unfamiliar phenomena into familiar terms, a heavily Latinate vocabulary, and a very limited technical lexicon. Samuel Danforth of Cambridge, Massachusetts, who has as good a claim as anyone to the title of first American scientist, is typical in these respects.[5] For example, his Astronomical Description of the Late Comet (1665) is syntactically straightforward, with very short sentences even by modern standards; ponderously learned ("This Comet is no lunary Meteor or sulphureous Exhalation, but a Celestial Luminary."); and simplistically metaphorical ("A Comet is denominated from its Coma or Bushy lock, for the Stream hath some resemblance of a lock of hair."). Since the colonial audience for such works was severely limited--amateur enthusiasts, scattered University faculty, and the clergy--the usual outlets were British publications such as the Philosophical Transactions of the Royal Society, Medical Observations and Inquiries (1757-84), and Medical Essays and Observations (1733-42), which despite their titles accepted communications on a complete range of scientific topics.

Along with the clergy, physicians constituted the largest class of scientifically literate persons in the colonies, though apparently less than one in ten had the benefits of formal education.[6] A medical disaster, the outbreak of the "throat distemper" in New England during the 1730's, provided the impetus for the first extensive medical publication in America. The letters, pamphlets, and newspaper articles published at this time show the range of styles writers adopted and their awareness of different audiences. Descriptions of symptoms by a clergyman and two physicians indicate very different responses to the problem of style:

Rev. Jonathan Dickinson: "I take this Disease to be naturally an Eruptive milliary Fever. And when it appears as such, it usually begins with a Shivering, a Chill, or with Stretching, or Yawning; which is quickly succeeded with a sore Throat, a Tumefaction of the Tonsils, Uvula, and Epiglottis, and sometimes of the Jaws, and even of the whole Throat and Neck. The Fever is often acute, the Pulse quick and high, and the Countenance florid."

Anonymous (probably Dr. John Morgan): "During these appearances, the throat seem'd, as it were, full and swell'd and the patient seldom failed to complain of great soreness, had an evident hoarseness and sometimes a cough. The pulse was generally full and quick, yet attended with some remissions and even sinkings."

Dr. William Douglass: "[T]he reliquiae were thrown off by Urtications, by Vesications in several parts of the Body, by serpiginous eruptions chiefly in the face, by purulent Pustules, by Boils, by swellings and impostumations in the groin, armpits and other parts of the body."[7]

The first two passages address a lay audience and thus communicate in relatively familiar terms. The style of the clergyman and the physician are essentially indistinguishable, though Dickinson uses a slightly more elevated vocabulary. Elsewhere in their articles, both suggest a humane concern for the patient, Dickinson referring at several points to the struggle of "the poor miserable Creature." Their sense of stylistic decorum also permits literary allusions and stylistic ornaments to play minor roles: Dickinson characterizes the disease as a mortal enemy, and Morgan depicts his struggle in dramatic and military images and at one point alludes to Dryden to underscore his opposition to bloodletting.

Douglass's description more closely resembles the jargon-laden prose for which physicians have become notorious, especially when addressing other "Gentlemen of the profession" (p. ii). Even to his colleagues, however, his elaborate phrasing is excessive: Dr. Samuel Bard, a professor of medicine at Columbia, though quoting him approvingly for his "accurate and judicious" observations, finds them needlessly obscured by his "singularity of style."[8] In fact, Douglass's high-sounding vocabulary describes such commonplace phenomena as blisters (vesications), a spreading rash (serpiginous eruptions), and abcesses (impostumations).

In the twentieth century, the motives for producing a given piece of technical writing are conventional, clearcut, and objective: the advancement of knowledge, generation of a specific output or product, or meeting some predetermined goal (e.g., reporting progress or proposing some course of action). Personal motives, such as advancing one's career or reputation, remain implicit. In the early years of scientific activity, motives are more diverse and tend to be stated directly. They include patriotism and the desire to be useful to society, the desire to spread rather than advance knowledge, personal ambition, stimulation of controversy or at least parallel activity, inquiry (often disarmingly naive), and, perhaps most important, the desire to create the bonds within a field of inquiry which will lead to its professionalization.

Most of the latter motives can be inferred from the writings under consideration. The most apparent are the desire to be useful, to promote professional standards, and to stimulate scientific activity in others. All three writers insist that their writing promotes the general welfare by sharing their specialized knowledge with the public. All also point with satisfaction to their professional concern for detailed observation; Morgan is exemplary: "As the State of Physic now stands, the Faculty having been amused with different Theories for many ages have concluded, that reasoning from observation and facts . . . is the only basis on which we can rest with safety" (p. 164). This Baconian emphasis is the single trait most common in all early American science and the most obvious method of distinguishing cognoscenti from amateurs. In subsequent years, a significant proportion of the papers the APS rejects are cited for their failure to observe and describe with scientific thoroughness and accuracy. Douglass is concerned not only with standards of observation (his labored vocabulary no doubt to his mind contributes to this objective), but also with using publication specifically to establish a network of researchers cooperating on a common problem. Douglass is also careful to underline his objectivity by dissociating himself from those who publish their findings solely as a "Quack bill to procure Patients" (p. ii). Half a century later, the hope of eliciting professional cooperation stimulates the editors of the Medical Repository, the first successful American medical journal, who see a "medical collection" of "an extensive mass of experiment [and] a various and judicious selection of facts" as the surest way to progress.[9]

The need of early scientific writers to establish credibility necessitated a personal tone far removed from the conventional objectivity of modern practice. Just as seventeenth-century correspondents to the Royal Society were careful to include such code words as "ingenious and industrious" or "curious and inquisitive" gentlemen in identifying themselves and their informants, American writers in the eighteenth century are careful to account for their sources' reliability and, if at all possible, to observe phenomena with their own eyes. An excellent instance

of this trait occurs in another of Dr. Morgan's papers, an account of "A Living Snake in a Living Horse's Eye" in the APS Transactions. Morgan devotes two pages to discussion of "miraculous appearances," his own opposition to "visionary speculatists," his hypothesis that the creature in question is a "filimentary production" animated by a "convulsion in the nerves," and, finally, his assurance after "the closest ocular examination" that the "snake" (actually a parasitic worm) is genuine.[10]

One result of this need to establish one's personal credibility is a more argumentative tone in much of the writing than modern conventions would permit. Douglass, for example, refers scornfully to the "rash inconsiderate opinion[s]" and "mischievous Practice[s]" of other physicians treating the throat disorder (pp. 2-3). In this combative atmosphere, it was normal for such arguments to be quite protracted. Manuscripts in the APS archives indicate that the inventor Oliver Evans continued to inveigh in print against Benjamin Latrobe for criticizing his steam engine eleven years after the fact, even though that criticism was a single paragraph (which Evans never saw) in a draft report which Latrobe excised prior to its publication.[11]

The most successful effort to impose order and standards upon scientific writing was the publication of the APS Transactions, a collection modeled closely upon the Philosophical Transactions of its parent organization, the Royal Society. The publication's history is too complex and its quality is too uneven to recount in detail here; during its initial stage of development, six volumes appeared at irregular intervals from 1769 to 1809. Its primary accomplishments are several: it imposed minimal standards for form, methodology, and style, though the latter were applied unevenly; it instituted an increasingly successful referee system to consider papers; although it usually published papers as received, it also printed the first edited and collaborative papers to appear in this country;and, most important, by distributing scientific writing far more widely than previously possible, it encouraged imitators and provided a model for potential contributors.

The standards for publication were not initially high; the Society's highly regarded observations of the 3 June 1769 transit of Venus across the face of the Sun comprised nearly half of Volume I, and other papers on hand in agriculture, medicine, mathematics, and natural history, including some previously published material, were included to add bulk and variety. A consistent standard, observed in all APS publications, is objectivity. The Society clearly specifies that its members will not "give their Opinion, as a Body, upon any subject, either of Nature or Art, that comes before them."[12] Occasionally this rule resulted in minimal editing, as in a paper by John De Normandie concerning "The Therapeutic Value of the Waters of Bristol, Pennsylvania," a republication

of two earlier articles in the Pennsylvania Journal and Pennsylvania Gazette (both 6 October 1768).[13] Two paragraphs are removed, perhaps because they have too much the tone of an advertisement, with references to the Bristol springs' "more remarkable tonick powers than common springs" and "a suitable and convenient house and bathing place" under construction. Except in extreme cases, the Society's official neutrality had little impact on the form or substance of its publications; certainly, it caused the removal of very few hypotheses because they were unacceptable. Only once during this period did the Society approach breaching its operating principle by showing favoritism to one of its own members. This occurred in 1806, when an editorial committee rejected a paper on the origin of icebergs by Samuel L. Mitchell and accepted a similar one within a few weeks by Anthony Fothergill, who was not only a member of the society but also of the committee. Moreover, Fothergill's paper is in many ways inferior: it contains undesirable rhetorical flourishes, is based upon less precise observations, and contains an inferior, contrdictory hypothesis, that icebergs are "gradually formed stratum super stratum . . . attache[d] . . . to the bottom" of the ocean, even though they are "specifically lighter than water." The committee raises the issue of the propriety of its action in its report, and the society as a whole eventually found an excuse not to publish Fothergill's paper.[14] However, nowhere else in the records of this period is there evidence which so obviously calls into question the Society's neutrality.

For the most part, the Society's principle of selection is, as stated in the first volume, "the importance or singularity of the subjects, or the advantageous manner of treating them" (I, iii). The latter phrase refers to the scientific rather than stylistic manner, the use of close observation, experiments, or statistical methods rather than careful writing. Nevertheless, the record indicates that style and form were considerations in some cases. The best example is provided by the record of Benjamin Shultz, an amateur naturalist whose work is best left cloaked in anonymity. Over a ten-year period (1797-1807), Shultz persistently submitted rather lengthy papers on noxious plants, essential oils, animal temperaments, and light. All were rejected, though Shultz sought the patronage of Thomas Jefferson and (more successfully, Dr. Benjamin Rush. Editorial comments on his papers are almost entirely negative ("extremely inaccurately written," "diffuse and irregular"), and the works themselves are models of prolixity, opacity, and confusion. His first paper, on noxious plants, is typical: the first section, eight of its thirty pages, is a rambling parody of a review of the literature, which alludes vaguely to many theories but cites no sources; the discussion itself (sixteen pages) is poorly organized (one-quarter is excursive footnotes and nearly one-half is simply lists of Linnean nomenclature) and riddled with semi-literate metaphorical descriptions("innocent plants," "naked . . . destitute of winged, downy, or hairy Substances," "Calyx . . . cherishing the Seeds in its bosom"); and a "Review" takes up the final six pages, again with nearly one-third of its text extraneous comments in footnotes.[15] Shultz's papers are

valuable only in that they indicate some minimal sense of an appropriate style for scientific writing existed at the end of the eighteenth century, although it is never clearly articulated.

The usual form of submission was the personal letter or memoir enclosed in a letter, although more formal presentations with textual subdivisions and elaborate figures appeared even early on, including at least one "formal report" (Samuel Felsted's "Plan and Description of a Horizontal Wheel," 6 July 1798), a fair manuscript copy, bound in boards, with three well-drafted, pull-out figures. All of the papers submitted at this time are the work of individuals, but a number of articles are collaborations and amalgamations. The most complex example of such an article is William Mugford's "An Account and Description of a Temporary Rudder," which derives from at least four sources: Mugford's original letter and description of the rudder; a newspaper account of its invention; a draft report combining the preceding items and commenting upon them; and an explanation of an illustration, apparently requested from Anthony Fothergill. The published article differs from all four sources in both substantive and stylistic details (including reinstatement of cancelled material from the draft), indicating that yet another writer or editor had a hand in it.[16] The Society did not generally have the editorial resources to rework submissions so elaborately; however, upon occasion a specialist was asked to rewrite or expand promising observations. The naturalist Benjamin S. Barton performed such duties on an anonymous "Observations on the Phalaeena Tinea" (a parasitic moth which inhabits beehives). He expanded a six-page document to forty-four, in the process transforming a chronological memoir into a topically arranged report which incorporated Linnean descriptions, a review of the literature, and his own and other observations from various sources.[17]

One of the APS's most important innovations was its introduction of specialists' committees to determine which papers were suitable for publication. The Society's minutes do not record when such review committees were first established or exactly why. Certainly, no explicit order was given. From its creation, however, the APS used ad hoc committees for such purposes as granting prizes, examining inventions, translating foreign correspondence, and seeing the first Transactions through the press. After the second volume appeared in 1786, references to such committees begin to appear in the minutes, the first on 21 December 1787; however, they are appointed, do their work, and report sporadically and haphazardly. Thirty-five such reports are extant from the period 1787-99, eighty-six from 1800-09, and twenty-three from 1810-15. These reports cover fewer than half of the papers received, and many were lost or delayed. On 27 December 1798, for example, the secretary reported on sixty-two papers received during 1797-98; two-thirds (thirty-nine) were listed as "referred,"

but only twenty committees actually filed reports. The archives also show embarrassing delays: Shultz's paper on noxious plants was in committee for over a year; Barton's paper on "Poisonous Honey" was read on 18 July 1794, never reported upon, and finally published only in Volume V (1802). The worst fate is Robert Patterson's, whose "An Improvement in the Common Ship-Pump" was read on 17 July 1795 but "afterwards mislaid"; it emerges in print twenty-three years later in Volume I of the new series (1818). Such delays were destructive of the journal's prestige and credibility, and competing periodicals were able to publish backlogged papers (four such instances were noted in the minutes in November 1812). The society's most prestigious member, Joseph Priestley, complains in 1798 that he has been forced to send "Articles . . . of considerable importance" elsewhere because the Transactions does "not answer the primary purpose of such publication, which is speedy communication of philosophical discoveries.[18]

By the opening years of the nineteenth century, the sporadic, compendious, uneven Transactions had served its purpose. It had launched American scientific publication, provided some minimal standards for both form and content, and had demonstrated a potentially workable system of manuscript selection. Most important, it had shown that American scientists could work cooperatively and objectively to disseminate the results of their research. The next stage of development, the publication of specialized journals like the American Mineralogical Journal (1810), could not have occurred, nor could such journals have taken on so modern an appearance, without the pioneering work of the APS. Thus, the first generation of scientists in the new republic made substantial progress and paved the way for the professionalization and specialization of scientific communication. Their work, with all its shortcomings and peculiarities, is recognizably the ancestor of modern technical writing; continued study of the historical record will show not only how modern conventions of writing emerged, but also how they were shaped by the socio-cultural forces, creative energies, and personal values common to all scientific, indeed, all human, endeavors.

NOTES

[1] "Observations on Style," The Rudiments of English Grammar (1761; facs. Menston, Yorkshire: Scholar, 1969), p. 50.

[2] Lectures on Rhetoric and Belle Lettres (Philadelphia: Aitkin, 1784), p. 81.

[3] The Pursuit of Science in Revolutionary America, 1735-89 (Chapel Hill: Univ. of North Carolina Press, 1956).

[4] Donald Fleming, "American Science and the World Scientific Community," Journal of World History, 8 (1965), 667.

[5] An observation best relegated to a footnote: the first sentence of the first American publication one could conceivably call scientific, Danforth's An Almanack for the Year of Our Lord 1647 (Cambridge, MA: Matt. Day, 1647), begins with a literary metaphor: "The great luminary, the world's bright eye shall be twice eclipsed this yeare."

[6] Roger Shyrock, Medicine and Society in America, 1660-1860 (NY: NYU Press, 1960), p. 9, estimates that in 1770 only about 200 of 3500 colonial doctors actually had degrees.

[7] Observations on that Terrible Disease Vulgarly Called the Throat Distemper (Boston: Kneeland and Green, 1740), p.2; "Observations on the Angina Maligna, or Putrid and Ulcerous Sore Throat," American Magazine, 1 (June, 1769), 165; The Practical History of a new Epidemical Miliary Fever with an Angina Ulcusculosa (Boston: Fleet, 1736).

[8] Samuel Bard, "An Inquiry into the Nature, Cause, and Cure of the Angina Suffocativa, or Sore Throat Distemper," APS Transactions, OS 1 (1769), 333.

[9] "Cicular Address," 1 (1797), vii.

[10] OS 2 (1786), 385-86.

[11] Benjamin Latrobe, "Report [on] Improvements in the Construction of Steam Engines," 27 May 1803; to John Vaughan, 19 June 1814, both in APS Archives. Unless otherwise noted, all remaining citations are from the APS Archives.

[12] "Advertisement," APS Transactions, OS 1 (1769), iv. The Royal Society had a similar regulation from its inception.

[13] APS Transactions, OS 1 (1769), 70-76.

[14] "Report of the Committee [on] . . . Dr. Mitchell's Paper, " 4 April 1806; "Report of the Committee on Fothergill's Paper on Ice-bergs," 2 May 1806; "Report of the Committee [on] . . . Dr. Fothergill's Memoir," 3 October 1806; Fothergill, "On the Origin and Formation of Ice Islands and Their Dangerous Effects in Navigation," Memoirs of the American Academy of Arts and Sciences, 3, pt. 1 (1809), 69-81; Mitchell, "An Exhibition of Facts, Showing the Progress of Ice-Islands," Medical Repository, 2nd ser. 4 (1807), 225-35.

[15] Shultz to Thomas Jefferson, 7 November 1797. Committee reports on Shultz's papers, listed chronologically in the Archives, occur on

7 December 1798, 7 February 1800, 2 April 1802, and 17 July 1807. His essay "On Essential Oils" is at the APS in the papers of Benjamin S. Barton under "Miscellaneous Papers."

[16] Mugford to Thomas Hewson, 22 September 1804; "New Rudder," Salem Register, n.p., n.d. (filed with Fothergill, "Remarks"); "Committee Report [on] Mugford," 13 February 1805; Fothergill, "Remarks on Mugford's Rudder," 15 February 1805. The article appeared in APS Transactions, OS 6 (1809), 203-08.

[17] W.J., "Observations," 1 November 1812; Barton, "Additional Observations on Bee-Hive Moths," 16 December 1812.

[18] Priestley to Benjamin S. Barton, 8 August 1798. Pennsylvania Historical Society.